Armed Forces College of Medicine

AFCM

Immunization

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INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

1-Compare between active and passive immunization.

2- Outline different strategies for development of vaccines.

3-. Outline passive immunization regarding indications , types and complications.

IMMUNIZATION

الكتاب المادة مجانيا

Definition

Induction of protection against infection with pathogenic organisms by **artificial safe procedure**

IMMUNIZATION

Definition

Induction of protection against infection with pathogenic organisms by **artificial safe procedure**

Ways

ايجابي

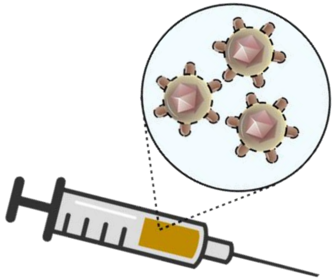
Active immunization (Vaccination)

Passive immunization

	Active immunization : Vaccination	**Passive immunization**
Method	Using **killed or attenuated** microbe or **part of it** ↓ ⊕ host to produce Abs / or effector T cells	Transfer of **preformed Abs or antitoxins** from immune individual or animal
Onset of protection	**Delayed** : appears after a lag period	**Immediate**
Duration of protection	**Long term** (many years) due to memory cells	**Short term**

Active Immunization By Vaccines

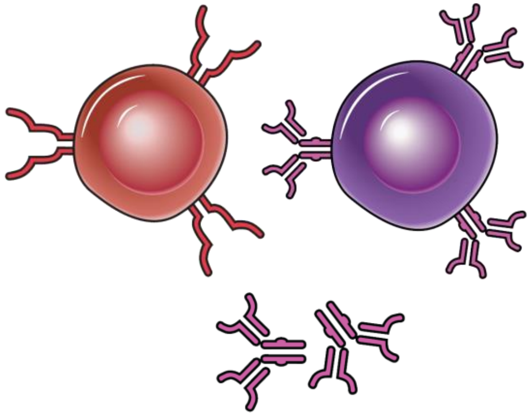
Definition of vaccines



Any **synthetic** preparation producing **immunity to a disease**:

by ⊕ the production of

Abs and /or cellular immunity



without causing **severe infection**

No disease

STRATEGIES FOR DEVELOPMENT OF VACCINES

Whole organisms vaccines

Subunit vaccines

Recombinant vaccines

Strategies for Development of vaccines

I- Whole organisms vaccines

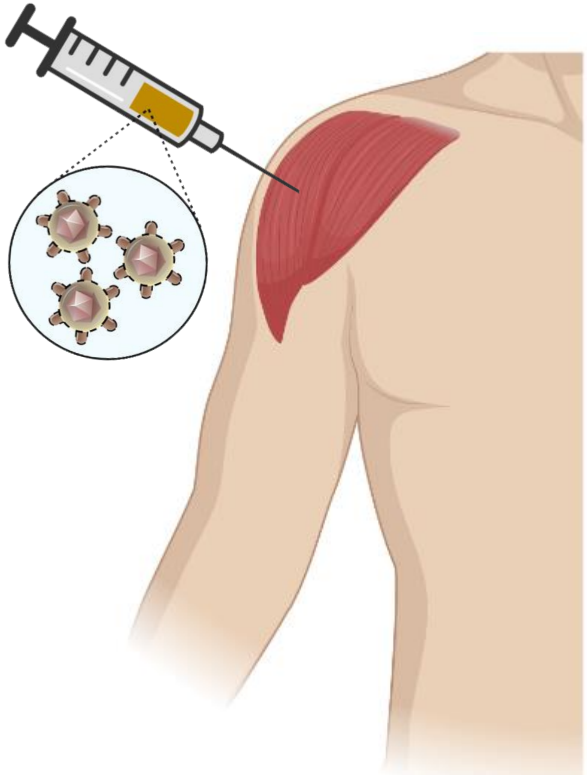
- Killed (inactivated) vaccines
- Live attenuated vaccines

Strategies for Development of vaccines

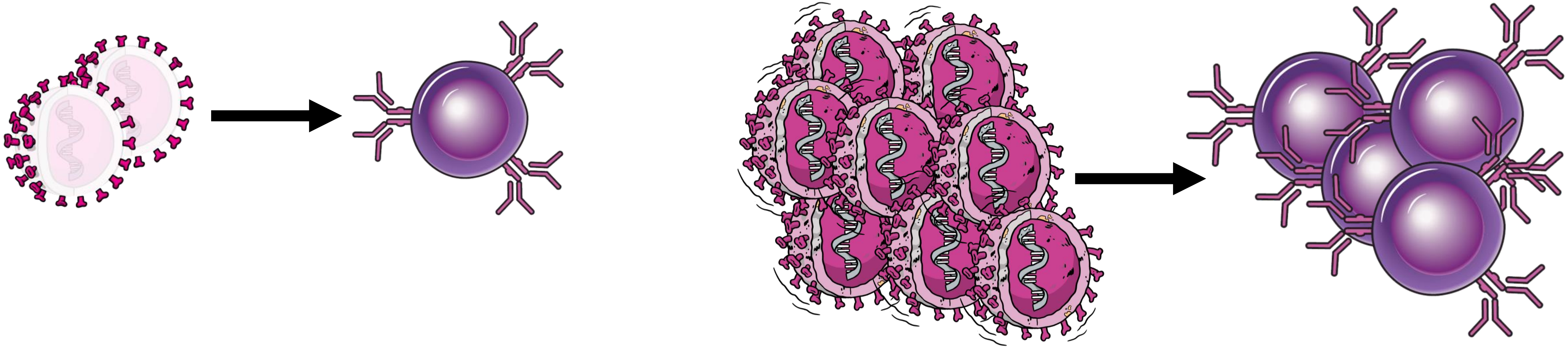
I- Whole organisms vaccines

	Killed (inactivated) vaccines	**Live attenuated vaccines**
1) Example	**Salk** vaccine of poliomyelitis	**Sabin** vaccine of poliomyelitis
2) Idea	**Pathogenic strain is killed (inactivated)** **No replication** ↓ No disease Maintaining epitopes on Ag	**Organism is attenuated** ➥ **Transient replication** in host cell ➥ **Mimics natural infection** but in **mild** form ➥ No disease
3) Method	1) **Heat** 2) **Chemicals** e.g formaldehyde,	1) Repeated subcultures under abnormal conditions 2) Genetic engineering
4) Adminis.	**Injection**	**Natural routes** of infection : Oral or intranasal

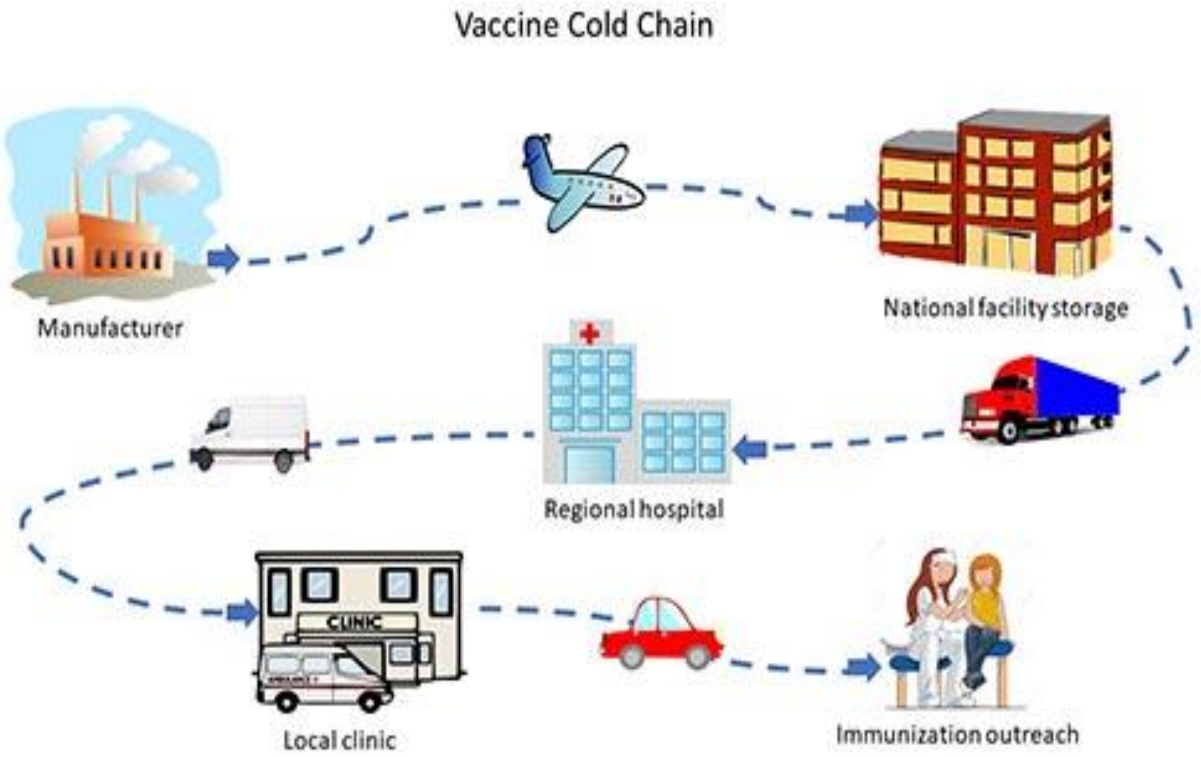
	Killed (inactivated) vaccines	Live attenuated vaccines
	4) Disadvantages	**4) Advantages**
Route	Given by **injection**	Given **orally** or **intranasal**
b-IR	**Inefficient immune response (mainly humoral)**	**Efficient IR (CMI & Humoral)**
Humoral Immun.		



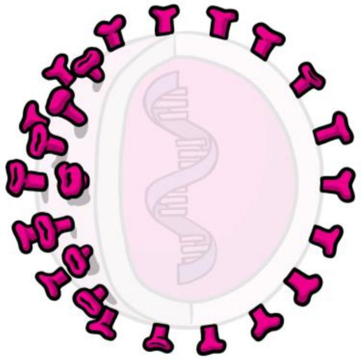
	Killed (inactivated) vaccines	**Live attenuated vaccines**
	4) Disadvantages	**4) Advantages**
a-Route	Given by **injection**	Given **orally** or **intranasal**
b-IR	**Inefficient IR (mainly humoral)**	**Efficient IR (CMI & Humoral)**
Humoral Immun.	**Induce systemic (IgG), but not local (sIgA) immunity**	**Induce both systemic (IgG) & local (mucosal sIgA) immunity**
CMI	**Weak**	**Strong (Th1&CTL)**
Duration	**Short** No multiplication in body → not similar to natural disease	**Long lasting** Multiplication of atten. org.in body → similar to natural ds

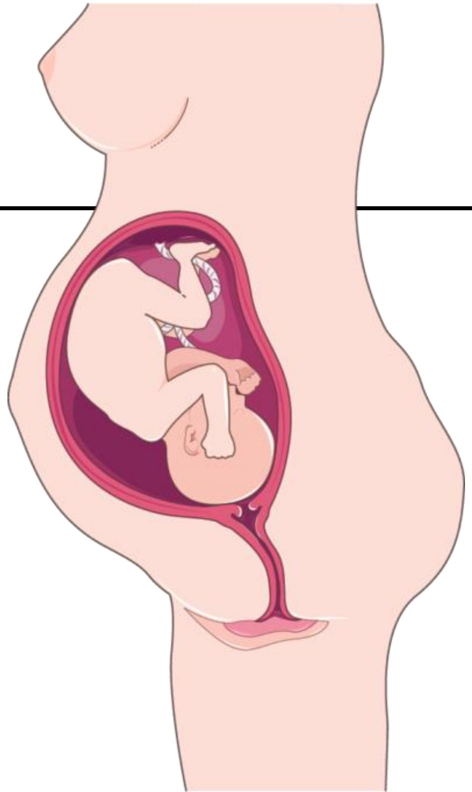


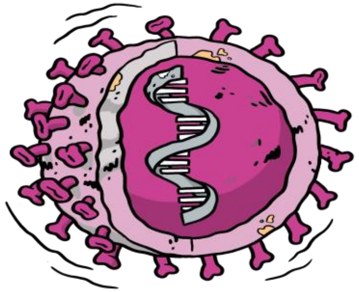
	Killed (inactivated) vaccines	Live attenuated vaccines
	5) Advantages	5) Disadvantages
Stability	**Stable** Don’t need cold storage	**Low stability** Need cold storage to maintain live attenuated viruses alive

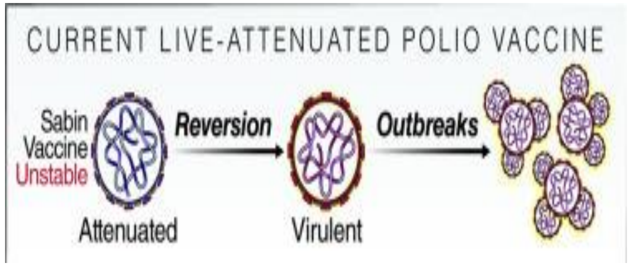


	Killed (inactivated) vaccines	**Live attenuated vaccines**
	5) Advantages	**5) Disadvantages**
Safety	**Safe** : **No contraindications** ↓ Can be given to: • **immunocompromised pts** • **pregnant ♀**	**Safety problems of attenuated strains** a) **Serious illness:** • in immuncompromized patients • during pregnancy (fetal damage) b) **Reversion to virulence** ➜ Disease production









II- Subunit vaccine

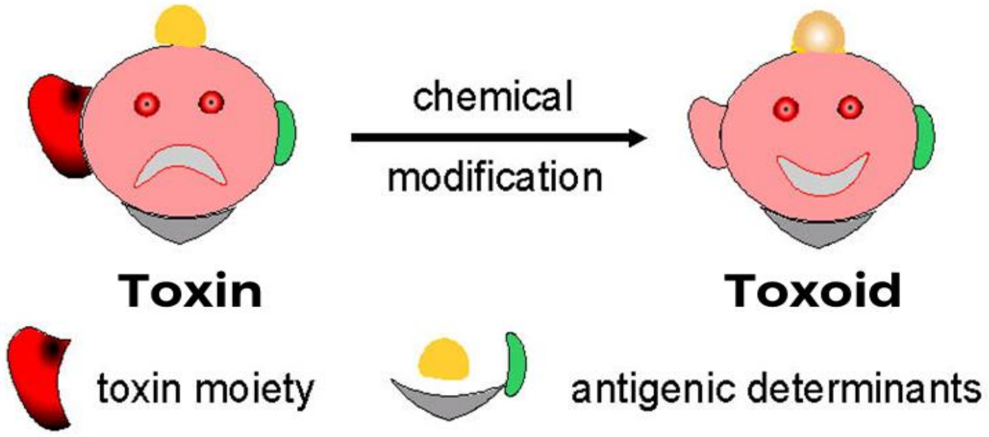
A) Bacterial polysaccharide (capsule) Ags

B) Toxoids: Inactivated toxins

A) Bacterial polysaccharide (capsule) Ags

	Polysaccharide vaccine	**Conjugated polysaccharide vaccine**
Preparations & characters	Polysaccharide **alone** ↓ Poorly antigenic as they are **thymus independent** Ags : ↓ **They are not presented to Th** ↓ 1) **Don't induce class switch:** Only IgM (No IgG or other classes) 2) **No memory** → No long lasting immunity	Polysaccharide **conjugated to protein** : ↓ **Strongly antigenic as they are thymus dependent** ↓ **1) Induce IgG** 2) Induce memory → **Long lasting immunity**
Advantages	No risk of infection	

B) Toxoids: Inactivated toxins



Preparation

- Bacterial toxin is **inactivated (modified) by formaldehyde**

↓

Toxoid : Non toxic, but antigenic

↓

Induces strong Ab response: antitoxin that will neutralize the toxin (if infection occurs)

Uses

To prevent diseases caused by **exotoxin producing bacteria**

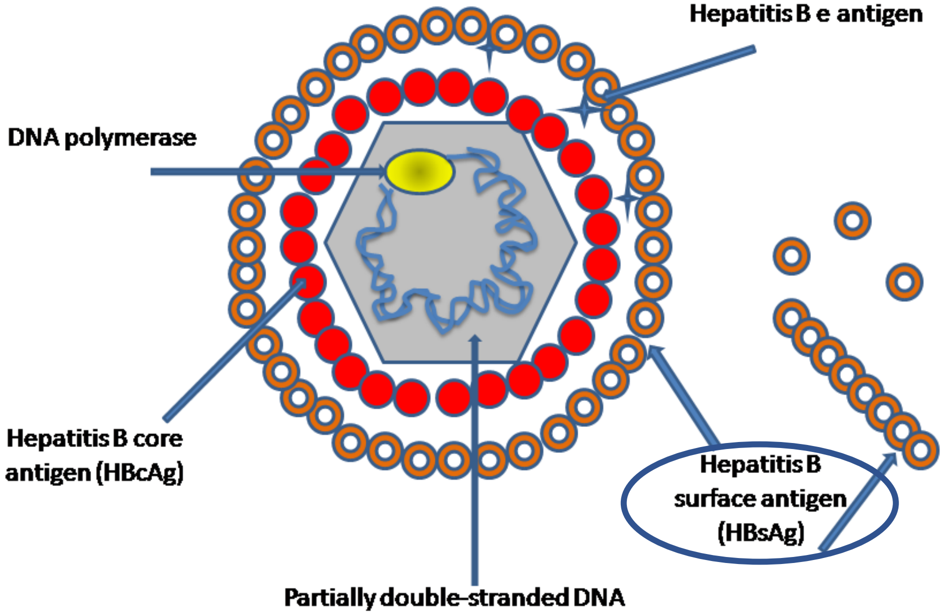
Hepatitis B virus

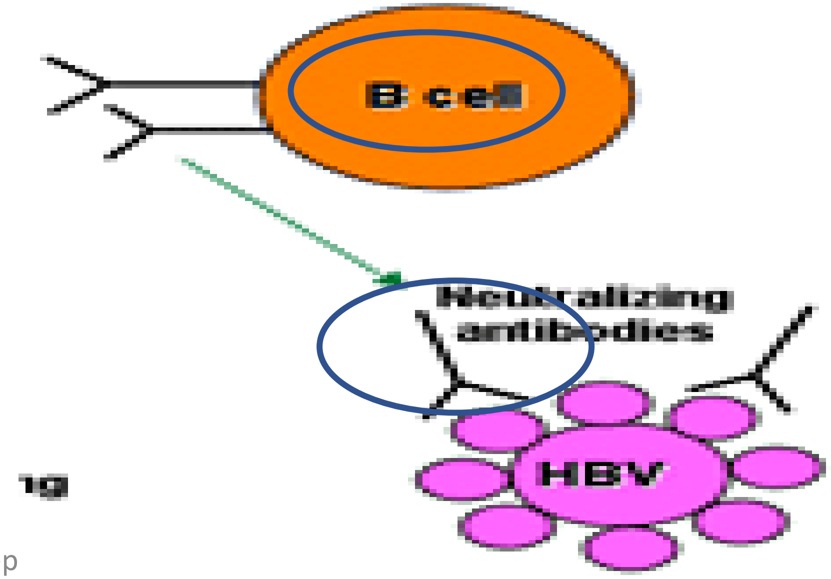
Envelope : carrying **s (surface) Ag**

Responsible for **viral attachment to liver cells**

⊕ production of **neutralizing Abs**

Long term protection against reinfection


Hepatitis B e antigen
DNA polymerase
Hepatitis B core antigen (HBcAg)
Hepatitis B surface antigen (HBsAg)
Partially double-stranded DNA



III- Recombinant vaccines (synthetic Ag vaccine)

Gene encoding antigen is Inserted into **plasmid (vector)**

↓

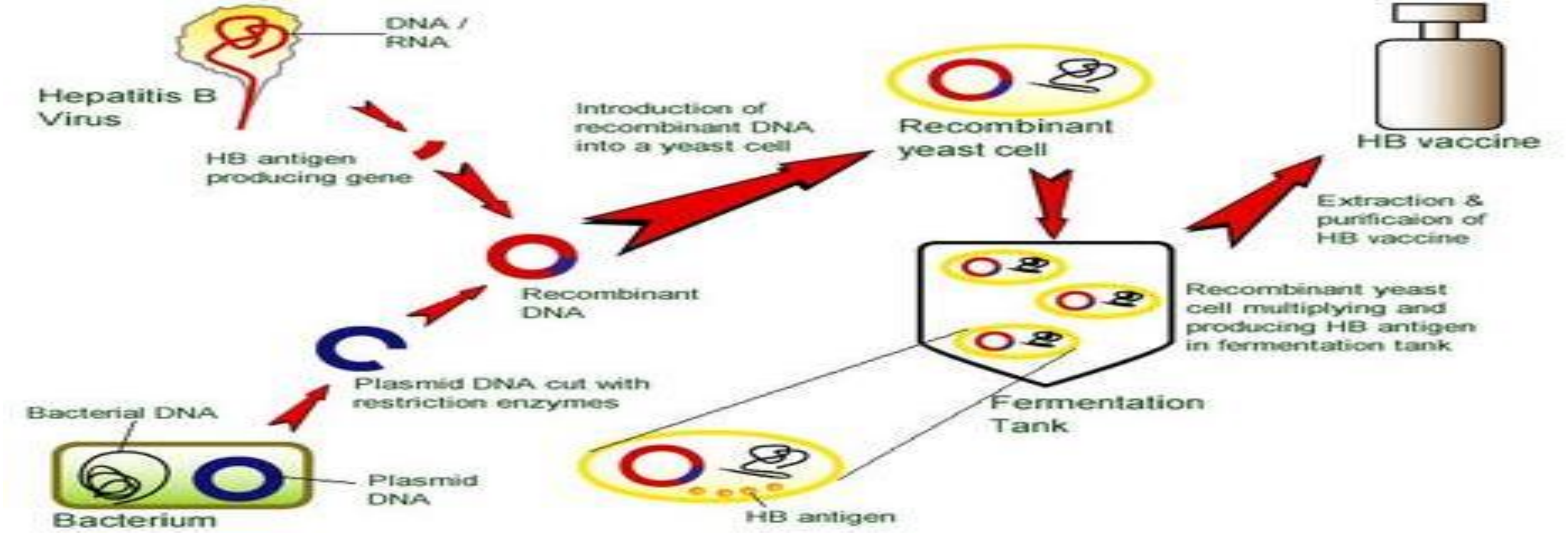
Plasmid is introduced into yeast

↓

Gene is expressed with production of Ag

↓

Ag is purified & used as vaccine e.g: vaccines of • HBV (sAg)


DNA / RNA
Hepatitis B Virus
HB antigen producing gene
Introduction of recombinant DNA into a yeast cell
Recombinant yeast cell
HB vaccine
Extraction & purificaion of HB vaccine
Recombinant DNA
Recombinant yeast cell multiplying and producing HB antigen in fermentation tank
Plasmid DNA cut with restriction enzymes
Fermentation Tank
Bacterial DNA
Plasmid DNA
Bacterium
HB antigen